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City Club Report Ballot Measures 5 and 6: Closure of Trojan Nuclear Power Plant

City Club of Portland (Portland, Or.)

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City Club Report
Ballot Measures 5 and 6
Closure of Trojan Nuclear Power Plant

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The City Club membership will vote on this report on October 16, 1992. Until the membership vote, the City Club does not have an official position on this report. The outcome of the membership vote will be reported in the City Club BULLETIN (Vol. 73, No. 22) dated October 30, 1992.
I. INTRODUCTION

The debate over the production of electrical power by nuclear fission in Oregon predates the commissioning of the Trojan Nuclear Power Plant (Trojan) in 1976 and continues with initiative measures 5 and 6 in 1992.

As charged, this report includes data, discussions and conclusions regarding those issues your committee found most important for consideration of both initiative measures by the voters. Your committee received presentations by Do It Yourself, sponsors of Measure 6, and Portland General Electric (PGE). Additional information was obtained from persons listed in Section XII who were interviewed by committee members, usually in teams of two.

Although your committee repeatedly invited chief petitioners of Measure 5, Don't Waste Oregon, to participate in this study, they chose not to be interviewed (see Section XII). The study committee used Don't Waste Oregon literature to represent their viewpoint and to extract their arguments.

The committee agreed to establish a common pool of information which is presented in the Data section. Not surprisingly, analysis of the data has resulted in a difference of opinion. This report contains both majority and minority analyses and recommendations.

II. TEXT OF THE MEASURES

MEASURE 5  Closes Trojan Until Nuclear Waste, Cost, Earthquake, Health Standards Met

Summary: Enacts new law. Suspends electric power generation at Trojan plant. Provides that no Oregon nuclear power plant, including Trojan, shall generate electricity unless the Energy Facility Siting Council finds, after a hearing: a permanent radioactive waste repository has been federally licensed and is accepting waste; the plant is then cost-effective, the plant can withstand major earthquakes without harming the public; and released radiation does not harm the public. If legislature declares electric power emergency and refers the question, voters may suspend or repeal this law.

MEASURE 6  Bans Trojan Power Operation

Summary: Act requires independent study of earthquake risk at, near Trojan site, plant's ability to withstand earthquake. Unless the Siting Council finds Trojan plant can withstand possible earthquake without harm to life, property, natural resources, plant must cease operation. Operator must pay for, cooperate with studies. Bans Trojan operation 30 days after Act takes effect until federal permanent waste storage site available or on-site storage does not exceed plant's annual production. Plant closing costs not includable in rates. Citizens may intervene in rulemaking, contested case proceedings.
III. BACKGROUND

A. Previous Ballot Measures

Measures aimed at closing Trojan have been on the ballot before Oregonians in the past. In 1980, Measure 7 was approved by the voters, prohibiting licensing of any new nuclear power plants. The City Club recommended against approval of the measure, but the study committee expressed "serious reservations" about waste disposal. In 1986, Measure 14 (similar to 1992 Measures 5 and 6) would have shut down operation of Trojan unless there were either a permanent disposal site or a declaration of emergency by the legislature. The City Club study committee recommended approval of the measure, but City Club members voted to accept the minority report recommending a vote against the measure. The measure was subsequently defeated by the voters. A similar measure in 1990 was not studied by the Club and was defeated by voters.

B. Similarities and Differences Between the 1992 Measures

Both 1992 measures would close Trojan in early 1993 unless certain conditions are met. Measure 5 requires shutdown within 120 days of passage if its requirements are not met. Shutdown would occur in the spring, after the winter power demand has passed. Measure 6 would require shutdown in 30 days. As in earlier measures presented to the voters, both measures in 1992 require the establishment of a permanent waste disposal site. As shown in the Data section, this requirement likely cannot be satisfied until well beyond the year 2000. Both measures require a finding by the Energy Facilities Siting Council that Trojan can withstand major earthquakes without endangering the public.

Measure 5, supported by Don't Waste Oregon, requires a finding of cost effectiveness as well as safety of both operation and disposal, but provides for suspension or repeal of all provisions if the legislature declares a power emergency and the voters concur. Measure 6 is supported by Do It Yourself and differs from Measure 5 in that no more than one year's accumulation of spent fuel can be stored on site.

In addition to issues of safety and waste, Measure 6 further stipulates that the costs of closing Trojan cannot be charged to ratepayers.

C. Trojan's Operation and History

The Trojan Nuclear Power Plant, completed in 1976, is located on the Oregon side of the Columbia River about 40 miles north of downtown Portland, and is Oregon's only existing nuclear power facility. The plant is licensed for operation until the year 2011. Portland General Electric (PGE) owns 67.5% of Trojan's output and is responsible for its operation.

Trojan's capacity is 1080 megawatts. Its average output over the past 16 years has been 58% of capacity. The plant is required to be shut down for about 60 days every spring for refueling, maintenance, safety inspections and repairs. Malfunctions cause additional downtime. Also, in times of plentiful, inexpensive hydroelectric power, it has proven to be economical for PGE to shut Trojan down and rely on other sources of power.
When Trojan was built, the industry contemplated that the federal government would provide facilities for the safe, permanent disposal of spent reactor fuel and other "high-level" radioactive wastes. The federal government now estimates that a disposal site will be operating by 2020. Past projections have proved wrong and proponents of the measures contend that a permanent disposal site may never be built. Until such a disposal site is operating, spent fuel from Trojan will continue to accumulate in the "spent fuel storage pool" adjacent to the reactor vessel at the Trojan site.

D. Changes Since the 1986 City Club Study

Several significant changes have occurred since the 1986 study:

- the amount of scientific information regarding the potential for earthquakes has increased significantly;
- knowledge of radiological hazards has increased;
- a surplus in power generating capacity no longer exists;
- Trojan's steam generators will require replacement in approximately four years;
- PGE has announced plans to close Trojan in 1996; and
- current drought and the listing of some salmon species as endangered have limited water supplies, restricting hydroelectric power generation.

E. Announcement of Closure By PGE

On August 11, 1992, PGE announced plans to close Trojan in 1996 rather than replace the steam generators. The effect of PGE's decision to shut Trojan down in 1996 is to shorten, by 15 years, the period of operation without the passage of either Measure 5 or 6.

PGE's decision to phase out operation of the Trojan nuclear power facility by the spring of 1996 is based on findings released August 31, 1992 in its Least Cost Plan. The plan was subject to a 30-day public comment period which ended September 30, 1992. A final plan will be submitted to the Oregon Public Utility Commission on November 15, 1992, for its approval.

IV. ARGUMENTS FOR AND AGAINST MEASURES 5 AND 6

The Committee has found that the following are the arguments advanced in favor and the arguments advanced against initiative Measures 5 and 6.

ARGUMENTS IN FAVOR

A. Plant Safety

- It has not been proven that Trojan can withstand a maximum credible earthquake.

ARGUMENTS AGAINST

- The plant design has been scientifically documented as able to withstand a major earthquake; preliminarily, independent academic research confirms this.
ARGUMENTS IN FAVOR

• The plant is more susceptible to human error or sabotage when the plant is operating versus closed.

• The plant is aging, and with a closure date of 1996 the risks associated with deferred maintenance are greater.

• Trojan has a poor operating history as shown by an above average number of Licensee Event Reports and safety violations in 1990 and 1991.

There are various possible scenarios that have been advanced which fall outside of the "beyond-design-basis" elements of nuclear plants. Therefore, if these scenarios occur, there is limited or no specific safety system protection.

• Steam generators are corroded—failure may cause off-site radiation releases. Until it is proven that allowable off-site releases are without impact on human health, Trojan should be closed.

• Regulators are too close to the industry and therefore are not able to impartially regulate safety.

• Trojan has had fatalities among plant staff.

ARGUMENTS AGAINST

• Security programs will remain in effect as long as the plant is operating. Human error will continue to be managed and minimized by extensive training programs and control room simulations.

• If maintenance/capital projects cannot be economically justified, and therefore are not done, the plant will be closed before 1996.

• Licensee Event Reports are a sign of thorough self-examination and of safety-minded attitudes by management of the plant. Government regulators have noted significant improvements by Trojan over the past 2 years—and Trojan is not currently in violation of any regulations.

• Intricate monitoring systems, a design element of the plant, continually look for radioactive emissions.

• State and federal regulatory agencies have on-site inspectors; both agencies report satisfactory compliance with safety regulations.

• The fatalities were in the non-nuclear portion of the facility and are not germane to the nuclear public safety issue.

B. Waste Storage

• Additional stored waste significantly increases the impact on life and property in the case of an accident.

• Safety of the spent storage pool is corroborated by public agencies and outside experts. Adding waste to the pool does not increase the risk of storage.
ARGUMENTS IN FAVOR

• The spent fuel storage is dangerously close to the Columbia River, making the effects of an accident dangerous to a larger geographic area.

• It is not ethical to burden future generations by adding more waste which is radioactive for thousands of years and for which no permanent storage is available.

• The amount of spent fuel storage should be brought into conformity with the original license 6-month on-site storage requirement.

• No new waste should be generated until the government approves a permanent storage site.

C. Management Capabilities

• Construction of new generation facilities would be better accomplished if executive management's attention were not distracted by operations of a nuclear plant.

• The best talent will leave Trojan seeking job security beyond 1996.

ARGUMENTS AGAINST

• The spent fuel storage pool is the "safest available" because it:
  1. is designed to withstand at least a 9.2 Modified Mercalli earthquake,
  2. allows spent fuel to be sufficiently cooled in the event of complete loss of water,
  3. was constructed on bedrock, and
  4. is well above the floodplain.

• Over four years, and compared to the total storage, the amount of incremental waste is small.

• Changes to Trojan's operating license regarding permissible on-site storage have been duly approved, and Trojan is currently within the storage requirements of its license.

• The Federal government is responsible for permanent storage—and nothing PGE or the Oregon voters do will change the long term storage problem.

• Managers for Trojan have unique and distinct responsibilities for nuclear operations. The Board and President of Portland General Corporation (holding company of PGE) have overall, coordinating responsibilities, other executive managers and subordinates do not have split responsibilities for nuclear and other non-nuclear managerial duties.

• Incentive plans have been implemented to retain talented employees. If enough skilled employees are not available, the plant will be shut down before 1996.

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1. In evaluating the arguments and data on earthquakes, proponents of both measures use the well known Richter scale that indicates the amount and duration of energy released at the source of an earthquake. PGE uses a Modified Mercalli scale that is used to estimate the amount and duration of earthquake energy arriving at specific location ( Trojan). It is difficult to state an exact equivalence between the two scales without a long list of qualifiers. We can generalize by saying that either magnitude cited would approximate one of the largest earthquakes ever measured, anywhere.
ARGUMENTS IN FAVOR

D. Economics

• Purchased, guaranteed system power is a less expensive source of power than Trojan. Immediate closure of Trojan would also result in the saving of approximately $100 to $150 million of routine operation and maintenance costs.

• Closure cost should not be passed on to ratepayers. If PGE underestimated the costs to operate and decommission the plant, PGE stockholders should pay for the resultant costs.

E. Alternative Power

• Purchased system power is readily available, as evidenced by:
  (1) Trojan was recently down for 240 days, without resultant blackouts to customers.
  (2) The Sacramento Municipal Utility District, in anticipation of closing their nuclear plant, received bids to develop energy resources that totalled 10 times more power than was needed to replace the lost nuclear power.

ARGUMENTS AGAINST

• The PGE Least Cost Plan indicates that immediate closure of Trojan versus closure in 1996 would cost an additional $400 million.

• Closure costs may be passed on to ratepayers, then taxpayers.

• Adequate power sources are not guaranteed because:
  (1) 1991 is not a valid indicator of future availability. 1991 was the second mildest winter on record; however, 1992 promises to be one of the worst drought years in history.
  (2) A 10:1 ratio between speculative bids and the amount of requested energy is not uncommon in the industry and is not to be taken as evidence of a real surplus.

• 1996 is a prudent closure date because:
  (1) Siting, approval, and construction of new generation facilities take a minimum of 3.5 years.
  (2) Conservation takes time to be realized as a source of power.
  (3) Cross mountain (east/west) transmission lines are being reinforced, with scheduled completion in 1994. Additional load, prior to upgrading, may result in outages.
  (4) The estimated remaining life of the steam generator is 4 years.
V. DATA

The entire committee debated and agreed on the inclusion of each informative entry which follows in this section. Both the majority and minority of the committee have drawn conclusions and made their recommendations based on analysis of these data.

A. Safety Issues

1. Radioactive Waste

In a power reactor such as the one at Trojan, a neutron splits a uranium atom into smaller atoms called fission fragments. This nuclear reaction is the source of energy used by Trojan to generate electricity. However, these fragments interfere with the splitting of uranium. After about three years, so many fission fragments accumulate in a fuel rod that the nuclear reaction within the rod is reduced below power generating levels. At this time, the fuel rod must be replaced even though nearly one third of the uranium has not been used. Although the level of radioactivity is too low for power generation, this spent fuel rod can be extremely hazardous if improperly handled or stored.

When construction of Trojan was approved, a state law prohibited storage of more than six months yield of spent fuel rods on site. The state extended the storage limits to one year and has subsequently removed all limits, save for continuing the classification of the storage as "temporary."

Permanent storage of high-level radioactive waste is a federal responsibility by act of Congress. However, no storage facility is expected to be able to accept waste before the year 2020. In the interim, spent fuel rods from Trojan are stored on site, and this stored radioactive waste constitutes an increased hazard that was included in the original permits.

At Trojan, as at most other power reactors, spent fuel rods are stored in a pool of borated water that absorbs neutrons, provides a shield for other forms of radiation, and provides cooling for the rods. Today, sixteen years worth of spent fuel rods as well as those in the reactor are stored on-site. Continued operation for four more years represents an increase of about 17 percent (110 tons) in the total quantity of spent fuel rods that will have to be stored on-site awaiting permanent disposition. According to PGE, Trojan's storage pool is at less than 50 percent of capacity, and there is ample space to accommodate this additional spent fuel.

2. Earthquakes

Three types of earthquakes are a potential threat to Trojan:

(1) those along faults within the continental plate similar to those in Southern California;

(2) those resulting from two plates sliding past each other; and

(3) those resulting from one plate being pushed under (subducted) another.

Plates are large segments of the earth's crust that move with respect to each other. This movement is the primary cause of earthquakes. Only recently has the subduction earthquake been recognized as a potential threat to Trojan. There has been a considerable increase in research in this area since 1986, and it is continuing.
a. Hazards to the Plant

The federal specifications under which Trojan was constructed contain detailed design standards which require that Trojan survive, with its safety systems intact, an earthquake equivalent to a magnitude exceeding 9.2 on the Modified Mercalli scale. This construction standard does not mean that Trojan could come back on line and resume transmitting power shortly after an earthquake of this magnitude. It does mean that in the event of such an earthquake, Trojan should not release radiation or radioactive materials that would be a danger to the public. Current understanding indicates that earthquakes would probably be much less severe than those assumed by the federal specifications.

PGE and Bechtel, the design and construction contractor, claim that Trojan's structure is significantly stronger than the minimums contained in the federal specifications. In order to verify this claim, the Nuclear Regulatory Commission (NRC), the Federal agency having regulatory jurisdiction over the safety of Trojan, has required PGE to analyze the earthquake resistance of each individual component of Trojan. As part of this study, the NRC has required PGE to identify and correct any items found to be out of compliance with the basic design specifications. This study is in progress. According to the Oregon Department of Energy (ODOE), the state regulatory agency, no major discrepancies have been found to date. Studies of the earthquake resistance of instrumentation at the plant are also not yet complete.

ODOE has studied the structures and vessels in the plant, and has evaluated Trojan's ability to shut down safely after a major earthquake. The conclusion of ODOE is that "there is sufficient design margin in the plant to allow safe shut-down in the event of a major earthquake."

Since the late 1980's, the NRC has required nuclear power plant management to continuously evaluate new information on external hazards such as floods, hurricanes, tornados, and earthquakes. In response, PGE published a detailed report on the Cascadia Subduction Zone which has been updated seven times. Based on an earthquake hazards assessment study conducted by the U.S. Geological Survey, PGE's report evaluates the impact on Trojan's seismic design and responds to questions from regulatory staff and consultants. This report is the basis of PGE's claims of Trojan's earthquake resistance.

Proponents of the measures demand that an earthquake study be conducted by independent consultants because they believe previous studies are biased in favor of PGE.

b. Hazards to Spent Fuel Storage

The spent fuel storage pool was designed to the same federal standards as the plant, i.e. to withstand a 9.2 Modified Mercalli scale earthquake. This pool is a 40 x 40 x 30 foot concrete tank with 5 foot thick reinforced walls and an 8 foot thick reinforced bottom which sits on bed rock. In addition, the tank is lined with 1/4 inch stainless steel. However, the proponents of the measures maintain that the spent fuel storage pool is unsafe in the event of a major earthquake. Your committee has considered the consequences of a rupture of the storage pool and the complete loss of cooling water. Four potential hazards from such an event were investigated:
• Potential Hazard from the Pool Water that Escapes

According to PGE and ODOE, the pool water is continuously filtered and purified to remove elements that could become radioactive; the water itself is not radioactive and does not constitute a radiation hazard.

• Potential for Melt Down

ODOE and Dr. Richard Webb, a nuclear physicist who has operating experience with reactors similar to Trojan, have said that there would be some heat build up, especially in fuel elements newly removed (within 30 days or so) from the reactor. The amount of heat generated would be insufficient to cause melt-down but would probably cause distortion of the fuel rod tubes and could break some seals. ODOE says that some of these seals break now in the reactor, and that is a prime reason for filtering and deionizing both the storage pool and reactor cooling waters. Additional broken seals would add to the load on the storage water purification system when the pool was refilled and restored to normal operation.

• Potential for Radiation

Part of the function of the water is to provide a lid on the radiation emitted by the spent fuel rods. The depth of the borated water is designed to maintain safe radiation levels around the top of the storage pool. According to ODOE, loss of this cap of water would subject areas around the pool to high levels of radiation, thus creating a serious radiation hazard to personnel repairing damage to the storage pool. The area of hazard would vary from tens to hundreds of feet away from the pool depending on the condition of the surrounding building. ODOE maintains it would not pose a serious threat thousands of feet or miles away.

• Potential for Release of Radioactive Noble Gas

Radioactive noble gases are chemically inert but can be hazardous to humans if the exposure is over a prolonged period of time, as is the case with radon in the basements of some houses. ODOE says that any releases of these gases from the Trojan storage pool would disperse quickly in the air and would pose no significant threat to off-site populations from a single, short-term exposure at very dilute concentration.

3. Safety Standards

a. Trojan's Design Safety

ODOE and the NRC have licensed Trojan to operate and oversee its operations. These agencies believe the plant is safe to operate, as do PGE and many engineers and scientists. However, other qualified scientists and engineers have questioned the operational safety of Pressurized Water Reactors (PWR) like Trojan. Specifically, Dr. Webb, a nuclear physicist with PWR operating experience, has questioned the safety of any PWR and claims there are specific design flaws that could lead to accidents more serious than Three Mile Island.

Proponents of the measures contend that the ability of Trojan to operate safely has been compromised by defects in the steam generator tubes. In 1991, 19% of the tubes were plugged (removed from service) due to cracking of the tube walls. Rupture of one of these tubes could begin a series of events that would result in the release of radioactive materials from the plant. While the cumulative percentage of plugged tubes in the steam generator exceeds the original design limit, the
percentage is within the subsequently revised limit, and is believed to be operationally safe by PGE and the regulatory agencies.

b. Effects of a Severe Accident

The NRC has studied the probability of a nuclear accident at plants similar to Trojan. Although the rating is not specific to Trojan, the NRC rates the risk to be, one severe nuclear accident every 5,000-40,000 years. A study by Sandia National Labs, under contract with the NRC, estimated that a severe accident at Trojan in 1980 could cause:

- 1,110 early deaths (within one year) within a 17.5 mile radius;
- 14,300 hospitalizations (within one year) within a 30 mile radius (downtown Portland is 40 miles from the plant); and
- 5,300 long-term cancer deaths.

PGE’s original permit application acknowledges that winds blow toward Portland nearly half the time. The effect of an accident would be most severe if the winds were blowing toward Portland at the time of the accident.

Up to date estimates based on changing demographics, inflation, and new knowledge regarding the negative effects of radiation on humans have not been made.

c. Evaluation of Safety Standards

US health and safety standards for radiation under which Trojan is licensed conform to international standards. However, the National Research Council has recently found radiation to be four times more lethal than believed when Trojan was permitted and licensed. Both Dr. Richard Belsey, M.D., Oregon Health Sciences University, and Dr. Rudi Nussbaum, Ph.D, Portland State University, have stated that the more we learn about the health effects of ionizing radiation, the lower our estimates of safe dosages become.

d. Trojan’s Adherence to Safety Standards

The performance of Trojan is evaluated annually by the NRC; it issues a Systematic Assessment of Licensee Performance report. This assessment discusses in detail Trojan’s performance in seven operational areas: plant operations; radiological controls; maintenance/surveillance; emergency preparedness; security; engineering/technical support; and safety assessment/quality verification. In the latest report released on June 30, 1992 the NRC comments, “Overall, the NRC found the performance of licensed activities at the Trojan Nuclear Plant to be generally good and directed toward safe facility operation.”

PGE, as required by law, reports on all deviations from regulations through a deficiency report called a Licensee Event Report. The deficiency reports, along with the reports of on-site inspectors and visiting inspectors, make up part of the annual evaluation. NRC has stated that it is pleased to see more deficiency reports from Trojan since that is an indication that PGE is looking at its operation more closely.

However, proponents feel that the increased number of deficiency reports indicates poor safety performance and is a cause for concern.
4. Regulators and Plant Management

a. Regulators' Impartiality

Proponents argue that the NRC's regulation of Three Mile Island was not adequate to prevent a multibillion dollar accident (with a debated possible loss of life). Although the NRC's internal procedures have changed since then, NRC personnel (including the inspector who warned of the risk at Three Mile Island) continue to resign, stating dissatisfaction with NRC closeness to the industry it is mandated to regulate. In addition, the immediate former NRC chief of staff has been accused of covering up drug-use allegations that he found believable, and acting to obstruct investigation of a troubled plant.

In 1986, the U.S. House of Representatives subcommittee that oversees the NRC found several serious flaws in NRC's regulation of nuclear plants. These flaws included reliance on the nuclear industry to regulate drug and alcohol abuse, watered-down fire protection standards, one instance of destruction of evidence, and no requirement that plants be upgraded for safety.

Jack Martin, NRC Western Region Administrator, stated that the problems brought to light in 1986 have now been solved and that the NRC is meeting its stated objectives.

b. Evaluation of Trojan Management

The NRC believes the general trend of performance at Trojan is improving. In Trojan's latest annual performance review, the NRC commends PGE for "relatively event-free performance during plant operation, scheduled outages, and the restart and power ascension during the extended refueling outage." However, that same report noted that "problems which do not rise to the attention of senior management are not being consistently addressed in an appropriate manner."

The Critical Mass Energy Project, a nuclear safety advocacy group, evaluated this nation's 111 operating nuclear power plants in 1991 and rated Trojan 13th worst. The group specifically noted that over a two year period records show that there were 32 safety violations (national average - 16.8) and 19 safety system failures (national average - 7.2). On the other hand, Mr. Martin stated that Trojan is one of the two best nuclear power plants in the Western Region. Further, Ivan Selin, NRC chairman, has said "Trojan's performance four or five years ago was not very good." But now, he states, the plant and its management are "better than average."

The ballot measure proponents have questioned Trojan management's ability to operate the plant properly and deal with morale problems that can occur in a plant scheduled to close. PGE says that it is well aware that morale problems, along with a loss of talented personnel, may occur because of the announced plant closing. PGE has disclosed specific incentive plans to deal with this issue.
B. Economic Issues

1. Impact on Taxpayers and Ratepayers

Your committee consulted counsel for both the Do It Yourself petitioners and PGE to determine the effect of closure on ratepayers and taxpayers. In addition, your committee studied opinions by the Oregon State Department of Justice.

The U.S. and Oregon constitutions both prohibit the taking of private property without just compensation. Counsel for PGE holds that the passage of an initiative measure which closes Trojan would constitute such a taking, and PGE would be entitled to seek compensation from the state. Although Ballot Measure 6 purports to prohibit the increase of rates to cover the cost of closure and decommissioning, it does not preclude compensation by the state, paid by the taxpayers.

The counsel for Do It Yourself notes that in June 1992 the United States Supreme Court said (in *Lucas v. South Carolina Coastal Council*) that a state need not compensate a private owner of a nuclear power plant which the state orders dismantled because it is found to be on an earthquake fault. Measure 6 restricts operation of Trojan as a nuclear power facility only until earthquake standards and waste storage standards are met. Once these requirements are met, Trojan can resume generating nuclear power. Thus, in his opinion, Measure 6 does not compel a "taking" of Trojan. In addition, the Supreme Court in *Lucas* also held that only regulation that denies all economically beneficial or productive use of land requires compensation. Proponents contend that PGE is considering using the Trojan site for non-nuclear power. The Trojan site could then be economically beneficial to PGE whether the nuclear plant is closed by voter action in 1993 or in 1996, as planned by PGE.

A 1992 Oregon Attorney General's opinion holds that the taxpayer could be held partially or fully liable for Trojan closure expenses. Should Trojan be closed by a vote of the people, the Oregon Public Utility Commission (PUC) has the right to determine the amount, if any, Trojan's owners should be compensated. According to the Oregon Department of Justice, "A utility that suffers economic harm from a shutdown as a result of action by the state likely would seek recovery from the state, not just from its customers."

In contrast to the potential public costs associated with immediate closure, the economic consequence of a severe accident at Trojan was estimated, by the Sandia Labs study of accident effects, to be $89.7 billion in 1980.

2. Alternative Energy Sources

The Northwest Power Planning Council, an interstate public body, states in its least cost plan, *1991 Northwest Conservation and Electric Power Plan*, that closure of Trojan will remove on average 760 megawatts from the regional power grid. The cushion of hydroelectric power that has served the Northwest in the past is being squeezed by a combination of drought and salmon protection measures. According to recent articles in *The Oregonian*, some large industrial users of interruptible power have already had their electrical supply contracts suspended because of the current shortage of hydroelectric power, even with Trojan on line producing 1000 megawatts. Closure of Trojan will require that all or a major part of its capacity be replaced. PGE has said that the only alternative source of power that is immediately
available is imported energy from the presumed surplus of other utilities coupled with a small reduction in demand through accelerated conservation efforts.

PGE maintains that east/west transmission line capacity within Oregon limits the import of energy, and that Trojan has accounted for the bulk of PGE power generated west of the Cascades. An expansion of east/west transmission capacity is in process, but this project will not be completed before 1994. Transmission lines are vulnerable during winter storms which correspond to peak electrical demands west of the Cascades.

During the recent 240 day Trojan outage for steam generator inspection, PGE was able to buy power at prices below the historical average unit cost of Trojan energy. However, PGE points out that energy demand was well below average during this time period because of an unusually mild winter. PGE said that it took advantage of the market surplus which was created as a result, and extended the 1991 shutdown to perform an exhaustive inspection and analysis of the steam generator tubes. PGE believes that purchases of power in a more typical winter season will mean higher prices.

Proponents argue that there is plenty of power available for purchase. They point to the fact that the Sacramento Municipal Utility District recently closed its nuclear power plant by a vote of the people, and despite concerns over energy shortages, the District received bids totalling ten times over the energy needed to replace the lost power from the Rancho Seco plant. PGE maintains that a 10:1 ratio between proposed resource development and the amount specified in the request for proposals is typical in the energy industry. Moreover, bids are not a valid indication of power actually available since many of the power proposals are based on speculative future development of generating capacity.

ODOE says that a minimum of 3.5 years is required to bring new power generating capacity on-line from the time a complete application is submitted to ODOE.

PGE plans to offset most of the missing Trojan power with natural gas turbines, at least one of which is planned to be located west of the Cascades. At present, natural gas is available (within the limits of transmission), and relatively inexpensive. Natural gas turbine generators are a flexible source that can be run at peak times and shut down at slack times. PGE notes that gas burns cleaner than other fossil fuels. Environmental limitations and external costs are therefore less, but not insignificant.

3. The Cost of Power

Proponents of the measure have noted that power has been available at costs below that of power from Trojan.

At 22.2 cents per kilowatt-hour, the cost of Trojan power in 1991 included production costs, decommissioning expense and waste storage costs, all of which were high in proportion to the amount of energy produced, because the plant was closed for maintenance most of that year. PGE notes that the 1991 cost is not representative and expects that fully allocated costs will approximate 4.8 cents per kilowatt-hour in 1992 (the 1990 adjusted cost was 4.4 cents per kilowatt-hour).
Purchased power in 1990 averaged 2.27 cents per kilowatt-hour, and has ranged from 1.8 to 3.8 cents per kilowatt-hour from 1990 to present.

However, PGE states that there is no assurance that purchased power will be more or less expensive than Trojan power in the future. It has calculated that additional costs incurred in the event of immediate closure could total as much as $400 million due to the cost of purchased power. PGE’s calculations assume that their phase-out plan would keep Trojan operating for 3.5 years at 60% of capacity and that power to replace that output will average 3.2 cents per kilowatt-hour. PGE figures the total cost of replacement power would be $650 million. This cost would be partially offset by reduced operating costs totalling $250 million over the 3.5 years. This reduction is based on the assumption that it would take two years to obtain a “possession only” license from the NRC; it would be two years before significant reduction in staffing could occur. The cost of replacement power during this time would be added to the cost of interim operations.

C. PGE’s Operational Plan

1. PGE’s Least Cost Plan

In August 1992, PGE staff presented a draft of its 1992 Least Cost Plan to the Board of Directors of the Portland General Corporation, recommending that Trojan be phased out in 1996. The Board approved the recommendation. The report shows that the recommendation to close was heavily influenced by the magnitude ($200 million plus) of the expenditure to replace the steam generators required to operate Trojan beyond 1996. According to the report, cost was the major factor for the decision, though political issues were considered to the extent that they could be quantified. PGE states that detailed technical and financial analyses included in the report were developed with the involvement of regulators, customers and other public agencies.

2. 1996 Phase Out Decision

For Trojan to operate until the end of its license life (2011), both the NRC and PGE have said that the steam generators will have to replaced within four or five years. The decision to replace the steam generators, at a cost exceeding $200 million, must be made now if the generators are to be installed in time. Based on its Least Cost Plan, PGE has decided not to purchase the steam generators and to phase out the plant in 1996 because it finds this course of action results in the least cost and assures short-term reliability of electric service.

PGE maintains that the 1996 phase-out decision is irreversible for several reasons:

- The Least Cost Plan was developed with advisory committees representing Bonneville Power Administration, Northwest Power Planning Council, the Oregon PUC and many other interested parties. Unilateral reversal of the decision by PGE would bear a heavy political liability.

- Replacement steam generators will not be available in 1996 unless they are ordered immediately. PGE’s adoption of this plan has precluded such an order.

- Management has made irrevocable commitments to its employees, including incentives to stay on the job and keep the plant operating through the phase-out process.
The Oregon PUC determines which costs associated with a utility can be passed on to ratepayers. For this reason, PGE has worked closely with the PUC in developing the Least Cost Plan. If the PUC approves the plan, PGE would have little grounds for requesting any future rate increases necessitated by special costs not specified in the plan.

If either or both initiative measures pass, PGE has said it will have difficulty replacing the power Trojan provides PGE customers. PGE would invoke all available legal measures contesting a forced shut-down in 1993, with the result that taxpayers would bear the added cost of the State's legal defense.

VI. MAJORITY DISCUSSION

For a majority of your committee, the debate over Measures 5 and 6 focuses on the relative importance of the need for power between 1993 and 1996 versus concern about the safety of continued operation and accumulated nuclear waste at Trojan.

A. Power Availability

The fundamental role that electrical energy plays in our lives cannot be ignored and needs to be considered as voters evaluate the measures before them. As a society we make continual tradeoffs between desired goods and the costs of providing them.

PGE has stated in its Least Cost Plan that "1996 reflects the earliest possible date by which we can acquire the ownership or contract rights to new resources with which to replace Trojan's output and guarantee continuous, reliable service to customers" and "...immediate shutdown would jeopardize our ability to meet our customers' power needs and regional utilities' ability to maintain voltage stability, particularly during likely high winter needs."

It is true that surplus market energy is available but four-year system guaranteed power contracts may or may not be available. Supplying power for 4 years in the spot-market, where price is affected by supply and demand, is not a sound method of replacing Trojan's operating capacity.

B. PGE's Least Cost Plan

The Least Cost Plan model was subjected to hundreds of simulations with a range of assumptions, resulting in various scenarios. The majority accepts as probable, these conclusive scenarios from the report:

- the PGE phase-out plan (closure in 1996) is less expensive to ratepayers than an immediate shut-down by approximately $400 million; and
- the PGE phase-out plan is less costly than continuing operations of Trojan to 2011 by approximately $100 million.

The majority of your committee argues that, although PGE's planned shutdown of Trojan in 1996 is not irreversible, it is unlikely that PGE will change that plan. The number of individuals and groups, both public and private, involved in making this decision obligates PGE to follow through. Convinced of this, the ma-
The majority of your committee recognizes the potential for a catastrophic accident, but the probability of such an accident between 1993 and 1996 is extremely low. There are inherent, unforeseeable risks of a catastrophic accident at a nuclear powerplant which are unique to the nuclear industry and unlike the risks associated with any other power generation method. However, a majority of the committee finds that the design and management plans for Trojan include sufficient provisions for preventing anticipated public health risks in the event of an earthquake and/or on-site operational errors.

On balance, the majority sees a trade-off between the less likely risk to human life, property and the environment compared to the more likely risk associated with non-guaranteed energy sources in the short term. The time frame is the "short term", because the majority of the committee argues that long term spent fuel storage and safety are not appropriately a part of this debate. Regardless of ballot measure outcomes, permanent nuclear waste disposal is a long term problem. The U.S. Congress decided that it is a federal responsibility to provide for permanent storage of high level radioactive materials. The majority accepts that PGE management has little ability to influence the establishment of a repository. The additional spent fuel generated during the phase-out period (17 percent), does not critically alter the long term risk inherent in on-site storage or ultimate transportation to a permanent disposal site. Immediate closure of the plant would not result in spent fuel storage being relocated from Trojan. It will remain there indefinitely until a permanent federal storage site is selected, licensed and operational. Proponents and opponents agree that this is not likely to happen before the year 2020.

The possibility and impact of an earthquake at Trojan have been studied and reviewed by the NRC and ODOE. However, questions persist regarding the objectivity of these studies. With the backdrop of certain closure in 1996, the majority of the committee has confidence that these studies have been adequately reviewed to ensure plant safety.

The majority of your committee views Trojan's recent safety record, albeit not perfect, as a show of improved performance, particularly regarding the NRC's annual evaluation reports. In addition, the apparent commitment by PGE management to instill a culture of self-examination and correction at the plant, the decreasing number of deficiency reports, as well as the decreasing severity of events, bode well for a management on the mend and in control.

D. Phase-out Rationale

Your committee heard from a variety of sources that future power availability may not follow historical trends because:

- the Northwest power grid is balanced, with little or no excess capacity;
- 1991's winter was the second mildest in reported history;
- continuation of the current seven year old drought is possible; and
• salmon runs are endangered.

Therefore, the majority of your committee accepts the 1996 phase-out plan as presented by PGE as the most responsible alternative because it:

• maintains power availability in the short term;
• provides adequate time for construction of replacement generation capacity;
• allows for system upgrades, power switching and conservation to reduce requirements for supply-side resource development; and
• minimizes the cost to ratepayers.

E. Legality

Complex legal issues are raised regarding the provision in Measure 6 that closure costs be excluded from the rate base. Measure 6 proponents feel that PGE is not entitled to any special guaranteed right to pass closure costs to ratepayers. PGE indicates that an unlawful taking of Trojan (an asset that has economic value) amounts to condemnation, and will undoubtedly seek appropriate legal remedies. The majority is concerned that passage of this measure may create a legal liability for Oregon taxpayers and that the amount is not insignificant. If PGE's $400 million figure holds, it represents about 14 percent of the state's one year general fund.

The majority of your committee believes an immediate shutdown has the very real potential of affecting our daily lives. The effects could range from restricting personal spending options (more money spent on power rather than other items) and employment (interruptable customer cutoff) to the possibility of unforeseen power failures due to overloaded systems. The majority asks, are these immediate sacrifices commensurate with the risks incurred by several years of continued operation?

VI. MAJORITY CONCLUSIONS

Following the August 10, 1992 decision by the Portland General Corporation to phase-out the Trojan Nuclear Power Plant in 1996, the majority of your committee views the voter's choice as one of overriding PGE's decision and closing down the plant immediately. Further, the majority concludes:

(1) PGE could not easily reverse its decision to close Trojan in 1996.

(2) The short-term risks inherent in the continued operation of the plant for an additional three and one half years are acceptable because:

• in sixteen years of operation Trojan has had no incident involving a significant release of radioactivity; and

• the reactor and storage pool are designed to survive, without release of radioactivity, earthquakes of such severity that they have no known precedent in this region.

(3) The additional spent fuel generated during the phase-out period does not critically alter the assessment of long-term risk inherent in on-site storage and ultimate transportation to a permanent disposal site.
Phase-out of the Trojan Nuclear Plant will cost less than immediate closure. The distribution of costs among stockholders, ratepayers, and Oregon taxpayers is a complex matter that cannot be resolved at the ballot box. Overriding the PGE decision risks a legal liability for Oregon taxpayers.

The risk of power shortages will be greater with immediate closure than it will be for phase-out.

VII. RECOMMENDATION BY MAJORITY

The majority of your committee recommend a "no" vote on both Measure 5 and Measure 6.

Respectfully submitted,
R. Evan Kennedy
Keith Pailthorp
B.J. Seymour
Rick Simpson
Christian Steinbrecher
Carl Von Dreele
Barbara J. Fields, chair

VIII. MINORITY DISCUSSION

In deciding the merits of the initiatives, we should not allow the highly publicized decision of PGE's four-year closure plan to sway our resolve to do the right thing.

Issues of importance to the minority of your committee are fourfold:

• Economics
• Safety
• Legality
• Morality

A. Economics

1. Need for Trojan's Power

The majority of the 1986 City Club study committee projected a much greater need for power than actually occurred. In spite of that, the 1986 committee still recommended shutdown of the plant. Recent history demonstrates that we use less power than we project.

The majority has relied heavily on PGE's Least Cost Plan to make its evaluation of power needs over the next four years. The minority of your committee finds this unwise and notes that formal review of the plan is not complete.

As previously noted, a Northern California utility recently closed its nuclear power plant and received offers for ten times more replacement power than it
needed, and that power was speculated to be less expensive than Trojan power. For the last full year in which Trojan operated at average capacity, purchased power was 49 percent less expensive than power generated at Trojan. Since Trojan's power has often been sold out-of-state and we have survived for long periods without Trojan power, Trojan is a resource we believe is not worth the risk of continued operation.

2. Regional Impact

Both measures call for the voters to balance an uncalculated economic impact of an alleged power shortfall on the Portland metro area against the death, injury and economic loss that would be caused by an accident at Trojan. The minority of your committee agree with the measure proponents and feel that the consequences of an accident outweigh the impact of a short-term power shortfall.

The U.S. House of Representatives subcommittee that oversees the NRC relied on the 1980 Sandia Labs study when it reviewed the economics of a disaster at Trojan. Assuming inflation since 1980 has been a steady three percent, compounding that for twelve years would increase the 1980 disaster cost estimate up to $127.9 billion dollars. This amount exceeds all the insurance provided by all nuclear power plant operators, according to NRC information, and that figure excludes many significant costs not covered by any insurance.

The impact of insurers' paying out such claims could have a significant impact on the national economy as well. What would happen to the national economy if the insurance companies of America were presented with such a bill to pay?

B. Safety

1. Earthquake

PGE has not documented that the instrumentation and controls will survive and function properly in the event of a 9.5 Richter scale earthquake at the Trojan site. A minority of your committee is concerned that the forces of such an earthquake could very well initiate an accident sequence releasing radioactivity, and PGE has not documented that it cannot.

Both initiatives require independent seismological reviews of the plant and its safety systems. The minority finds that requirement prudent. Trojan should be considered an earthquake risk until all possible failure modes involving earthquake forces at a 9.5 Richter, or maximum credible earthquake, have been analyzed and reviewed by experts independent of PGE and the industry.

2. Steam Generation and Pipe Erosion

The problems with steam generator tubing at Trojan have led to at least one reduction in safety margins. The chance of radiation leaks from steam generator tube failure, and the reduction in safety margins already made are a cause for concern. Additionally, the pipes that provide cooling to the reactor deteriorate with age. The consequences of this deterioration are uncertain.
3. **NRC Relationship with the Nuclear Industry**

As previously noted, the NRC has a controversial past. Multiple high NRC officials have performed questionable acts, by their own admission and the findings of a Congressional subcommittee. A minority of the committee is concerned that if we rely on the NRC to regulate Trojan, Trojan may not be regulated very well.

4. **PGE Operations**

The NRC has noted that the conduct of management at Trojan is a continuing concern, and problems which do not reach upper management are not consistently resolved. The plant has been independently rated the 13th worst in the nation by the Critical Mass Energy Project, a public interest group which reviews nuclear safety. A minority of your committee remains concerned about Trojan operations in the hands of PGE management.

5. **Chance of Accident**

New knowledge reveals more complications and previously unforeseen risks that increase the potential for a reactor accident. Corrosion of steam generator tubes in the reactor vessel and embrittlement of reactor vessel supports are risks recognized by the NRC that increase with every day of operation. Previous nuclear accidents at other locations were not anticipated and were not supposed to happen. The expert opinions evaluated by your committee challenge PGE and NRC claims of Trojan safety. The dangers of continued Trojan operation are of concern to the committee minority.

6. **Sabotage**

A minority of the committee view the complexity of Trojan as vulnerable. With plant closure dangling over the heads of plant staff, an employee might become unbalanced or angry at losing a job and wish to strike out by using the plant to threaten society. Outside saboteurs must also be considered. The minority of your committee considers risks of sabotage unacceptable.

7. **Spent Fuel Pool and Warehousing Waste**

Intensely radioactive substances will be warehoused at Trojan until 2020 or later. A minority of the committee considers it undesirable to add to this burden and to multiply the potential consequences of an accident in the storage pool or in the spent fuel handling cycle.

Arguably, if the technology to store this poison is flawless, then there is no risk. Flawless technology does not, however, yet seem to be the hallmark of Trojan, Hanford or other warehousers of nuclear waste.

8. **Dangers of Radioactivity**

PGE's own Final Safety Analysis Report shows the wind blows from the direction of Trojan towards Portland and suburbs nearly half the time. A minority of your committee believes that owing to new knowledge of radiation effects on humans, the 1980 Sandia Labs study casualty estimates should be scaled up by a factor of at least four. This risk to the citizens of Portland area is too great to be acceptable.
C. Morality

The minority believes that generating 110 tons of high-level nuclear waste over the next four years is morally and ethically wrong. No permanent waste storage site has yet been demonstrated to hold such high-level radioactive waste safely for the centuries required for the radioactivity to decay to inert safety.

Moreover, the Federal government, PGE and the nuclear industry have been irresponsible in the past in generating and mishandling such poison and should not be given the license to create more.

High-level radioactive waste can be lethal. Generating more waste for future generations to deal with is placing that burden and expense on our children and their children for our short-term benefit.

Is it ethical to give this danger to our children and future generations, in order to assure the current level of industry and the short-term convenience of Oregon consumers? The minority finds this horribly wrong.

D. Legality

1. Fiscal Impact on PGE, Taxpayers and Ratepayers

The U.S. Supreme Court found in the 1992 case Lucas v. South Carolina that state government could restrict the use of property without requiring compensation as long as some degree of value remains to the owner. Indeed, without this provision, there could never again be a restrictive change in zoning use. The minority believes, closing Trojan by either Measure 5 or 6 would not result in charges to taxpayers, since Trojan could still use the site for gas turbine or other non-nuclear power generation, as other utilities do.

The Oregon PUC will make the first determination of what PGE might be owed. If the PUC finds PGE should be compensated by the state, the minority of your committee views this cost to taxpayers as insurance—the price of protecting Portland and vicinity from the massive losses inherent in a severe accident at Trojan.

2. PGE’s Right to Change Closure Plans

Although PGE has publicly presented its plan to close Trojan in 1996, the plan has not been formally reviewed by the Oregon Public Utility Commission. When the final draft is submitted on November 15, 1992, the PUC will evaluate the merits of the plan. The opinion of the Commission establishes the basis by which future requests for rate increases will be evaluated. If it finds the plan prudent, the Commission would be justified in denying any rate increases for capital investment at the nuclear plant. The PUC has no regulatory authority to make PGE adhere to its four year closure plan.

The minority of your committee argues that business plans change; after all, the introduction of the four-year closure plan itself was a change announced only since this study committee began its work. PGE may decide to change its plans once more and keep Trojan open. For instance, it could decide to generate during winter months only when power needs are greater thus extending the life of the steam generators and allowing operation past 1996. Therefore, the minority is
convinced that the only certainty of closure before 2011 is the passage of one or both of these measures.

3. Differences Between the Measures

Measures 5 and 6 both seek to correct conditions at Trojan particularly in reference to the large amount of nuclear waste now on-site. There are differences in content between the measures, but either would achieve the desired result of closing the Trojan plant in short order. As noted previously, the question of who pays is of lesser importance.

VIII. MINORITY CONCLUSIONS

(1) Power has been, and is readily available from sources other than Trojan and from conservation.

(2) The power generated by Trojan is expensive. If Trojan were closed, and its power replaced by purchased power, savings to the taxpayer could result.

(3) Trojan is not a dependable source of power. In 1991, Trojan power was five times more expensive than normal because of prolonged outage at the plant.

(4) A major accident would result in such severe economic consequences that the Portland area would be crippled for generations.

(5) An earthquake or other accident might result in the release of radioactivity with unacceptable consequences lasting hundreds or thousands of years. This risk to future generations and their continued use of Oregon land for living and agriculture is unacceptable.

(6) Any accident causing off-site exposure to radioactivity could create death and injury to the innocent, and that is unacceptable.

(7) Given Trojan's poor performance when compared to the rest of the nation's plants, the likelihood of an accident is increased to needless levels.

(8) Ending Trojan power generation will diminish the risk of accidents or sabotage.

(9) Continuing operation of Trojan for even four more years will increase its accumulated nuclear waste by at least 17 percent—a dangerous inheritance to leave for future generations.

(10) PGE's decision to close the plant in 1996 is reversible and should not be relied upon.

(11) Both Measures 5 and 6 would close Trojan quickly, reducing the risk to the public and preventing the generation of additional high-level radioactive waste.

IX. MINORITY RECOMMENDATION

We recommend a closure of the Trojan plant, and advocate voting "Yes" on both Measure 5 and Measure 6.

Respectfully submitted,
John Edw. Bartley, III
Frances Caldwell
David Pex
A. Persons Interviewed

Note: Lloyd Marbet and Greg Kafoury from Don't Waste Oregon (Measure 5) Campaign Committee declined your committee's invitation to be interviewed due to disagreement over interview format and committee process. Repeated effort on the part of committee members did not resolve this issue. Your committee particularly regrets that Don't Waste Oregon could not be consulted regarding PGE's announcement to close Trojan in 1996. To the best of their ability, your committee has extracted arguments advanced by Don't Waste Oregon from the campaign committee's printed literature.

Aamodt, Marjorie, retired psychologist, author - *Three Mile Island Cancer Study.*

Aitken, Donald, economist, Union of Concerned Scientists.

Anderson, Marcia, Sierra Club.

Belsey, Richard, pathologist emeritus, Oregon Health Sciences University.

Caldwell, Richard, biologist, Northwest Aquatic Sciences.

Clark, Don, biologist, Portland General Electric.

Cook, Chris, public relations, U.S. Nuclear Regulatory Commission.

Cross, Jim, vice president of nuclear operations, Portland General Electric.

Day, William, study committee chair, majority chair, City Club 1986 Nuclear Plant Operation Ballot Measure.

Dyer, Richard, vice president of operations, utilities and supplies, Portland General Electric.

Farooqui, Saleem, senior geologist, Dames and Moore.

Harrison, Ken, president, Portland General Corporation.

Heintsmann, David, nuclear information specialist, Portland General Electric.

Hickey, Sue, assistant administrator for energy resources, Bonneville Power Administration.

Hicks, Denny, Trojan general manager for plant support, Portland General Electric.

Hinton, Floyd, minority chair, City Club 1986 Nuclear Plant Operation Ballot Measure Study Committee.

Lattimer, John, Oregon Legislative Fiscal Office.

Litchfield, Jim, consultant, former member, Northwest Power Planning Council.

Martin, Jack, administrator, U.S. Nuclear Regulatory Commission Region V.

McLean, David, manager and geothermal power explorer, CE Exploration.

Melfi, Jim, on-site inspector at Trojan, U.S. Nuclear Regulatory Commission.

Mikolaitis, Mike, manager forecast and planning, Portland General Electric.

Park, James, hearings officer, Oregon Building Codes Agency.

Perkins, Ken, division director for reactor projects, U.S. Nuclear Regulatory Commission.

Riccio, James, attorney, Critical Mass Energy Project.

Sautter, Steve, senior nuclear information specialist, Portland General Electric.

Scarano, Ross, division director for radiation safety, U.S. Nuclear Regulatory Commission.

Schlissel, David, president, Schlissel Engineering Associates.

Sparling, Lee, manager of electric rates and planning, Oregon Public Utility Commission.

Stewart-Smith, David, energy facilities manager, Oregon Department of Energy.

Tozian, Gregory, public affairs, *Do It Yourself* (Measure 6) Campaign Committee.

Walt, Tom, Trojan general manager of technical functions, Portland General Electric.

Webb, Richard, physicist, former operator of pressurized water reactor.

Williams, Bill, manager of nuclear safety and regulation, Portland General Electric.

Williams, Ross, manager, *Do It Yourself* (Measure 6) Campaign Committee.
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“Can Trojan Survive the Earthquake Scientists Say is Coming?”


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Madin, Ian, comments on the proposed UBC seismic zone changes for Oregon, letter from the Oregon Department of Geology and Mineral Industries, 12/91.


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